II year B.Tech
Course Structures and Syllabi
under R19 Regulations
**JNTUA Curriculum**

**Electrical & Electronics Engineering  B. Tech Course Structure**

**2nd Year to 4th Years Course Structure**

**Semester – 3 (Theory - 6, Lab – 3, MC-1)**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Course No</th>
<th>Course Name</th>
<th>Category</th>
<th>L-T-P</th>
<th>Credits</th>
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<tr>
<td>1.</td>
<td>19A54302</td>
<td>Complex Variables &amp; Transforms</td>
<td>BS</td>
<td>2-1-0</td>
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<td>2.</td>
<td>19A02301T</td>
<td>Basic Electrical Circuits</td>
<td>PC</td>
<td>2-1-0</td>
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<td>3.</td>
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<td>Power System Architecture</td>
<td>PC</td>
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<td>4.</td>
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<td>DC Machines &amp; Transformers</td>
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<td>2-1-0</td>
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<td>5.</td>
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<td>Semiconductor Devices and Circuits</td>
<td>PC</td>
<td>1-1-0</td>
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<td>6.</td>
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<td>Digital Electronics and Logic Design</td>
<td>PC</td>
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<td>7.</td>
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<td>10.</td>
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**Total** 21.5

**Semester - 4 (Theory - 6, Lab – 2, MC-1)**

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<td>BS</td>
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<td>Electrical Circuit Analysis</td>
<td>PC</td>
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<td>19A02402</td>
<td>Engineering Electromagnetics</td>
<td>PC</td>
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<td>PC</td>
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<td>Analog Electronic Circuits</td>
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<td>Python Programming</td>
<td>ES</td>
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**Total** 21

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Course Objective:
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

Unit-I: Complex Variable – Differentiation:
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, $e^z$, cos z, $z^2$) Mobius transformations (bilinear) and their properties.

Unit Outcomes:
Students will be able to
- Understand functions of Complex variable and its properties.
- Find derivatives of complex functions.
- Understand the analyticity of complex functions .
- Understand the conformal mappings of complex functions.

Unit-II: Complex Variable – Integration:
Line integral-Contour integration, Cauchy’s integral theorem, Cauchy Integral formula, Liouville’s theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor’s series, zeros of analytic functions, singularities, Laurent’s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).
**Unit Outcomes:**

Students will be able to

- Understand the integration of complex functions.
- Apply Cauchy’s integral theorem and Cauchy’s integral formula.
- Understand singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.

**Unit-III: Laplace Transforms**


**Unit Outcomes:**

Students will be able to

- Understand the concept of Laplace transforms and find the Laplace transforms of elementary functions.
- Find the Laplace transforms of general functions using its properties.
- Understand Laplace transforms of special functions(Unit step function, Unit Impulse & Periodic).
- Apply Laplace transforms to solve Differential Equations.

**Unit-IV: Fourier series**

Determination of Fourier coefficients (Euler’s) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval’s formula- Complex form of Fourier series.

**Unit Outcomes:**

Students will be able to

- Understand finding Fourier series expression of the given function.
- Determine Fourier coefficients (Euler’s) and identify existence of Fourier series of the given function.
- Expand the given function in Fourier series given in Half range interval.
- Apply Fourier series to establish Identities among Euler coefficients.
- Find Fourier series of wave forms.
Unit-V: Fourier transforms & Z Transforms:


Unit Outcomes:

Students will be able to

- Find Fourier Sine and cosine integrals.
- Understand Fourier transforms.
- Apply properties of Fourier transforms.
- Understand Z transforms.
- Apply properties of Z transforms.
- Apply Z transforms to solve difference equations.

Text Books:

2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India

Reference Books:


Course Outcomes:

After the completion of course, students will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy’s integral formula and Cauchy’s integral theorem to evaluate improper integrals along contours.
- Understand the usage of Laplace Transforms, Fourier Transforms and Z transforms.
- Evaluate the Fourier series expansion of periodic functions.
Course Objectives:
To make the student learn about
- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
- The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set, Tie-set, Loop, Co-Tree.

Unit- I Introduction to Electrical & Magnetic Circuits


Unit Outcomes:
- To know about Kirchhoff’s Laws in solving series, parallel, non-series-parallel configurations in DC networks
- To know about voltage source to current source and vice-versa transformation in their representation
- To understand Faraday’s laws
- To distinguish analogy between electric and magnetic circuits
- To understand analysis of series and parallel magnetic circuits

Unit- II Single Phase A.C Circuits

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of
Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

Unit Outcomes:
- To understand fundamental definitions of 1-ϕ AC circuits
- To distinguish between scalar, vector and phasor quantities
- To understand voltage, current and power relationships in 1-ϕ AC circuits with basic elements R, L, and C.
- To understand the basic definitions of complex immittances and complex power
- To solve 1-ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

Unit- III Three Phase A.C. Circuits


Unit Outcomes:
- To know about advantages of 3-ϕ circuits over 1-ϕ circuits
- To distinguish between balanced and unbalanced circuits
- To know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads
- To know about measurement of active, reactive powers in balanced circuits
- To understand about analysis of unbalanced circuits and power calculations

Unit- IV Network Theorems

Superposition, Reciprocity, Thevenin’s, Norton’s, Maximum Power Transfer, Millmann’s, Tellegen’s, and Compensation Theorems for D.C and Sinusoidal Excitations.

Unit Outcomes:
- To know that electrical circuits are ‘heart’ of electrical engineering subjects and network theorems are main part of it.
- To distinguish between various theorems and inter-relationship between various theorems
• To know about applications of certain theorems to DC circuit analysis
• To know about applications of certain theorems to AC network analysis
• To know about applications of certain theorems to both DC and AC network analysis

Unit- V Network Topology

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

Unit Outcomes:

• To understand basic graph theory definitions which are required for solving electrical circuits
• To understand about loop current method
• To understand about nodal analysis methods
• To understand about principle of duality and dual networks
• To identify the solution methodology in solving electrical circuits based on the topology

Course Outcomes:

After completing the course, the student should be able to do the following

• Given a network, find the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across and power through any element.
• Given a circuit and the excitation, determine the real power, reactive power, power factor etc.,
• Apply the network theorems suitably.
• Determine the Dual of the Network, develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts.

Text Books:

Reference Books:

Course Objectives:

To make the student learn about:
- The block diagram and operation of Conventional Power generating systems and their components.
- The role of non conventional power generating systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modelling of transmission line and evaluation of constants.

UNIT-I  CONVENTIONAL POWER GENERATING SYSTEMS

**Thermal Power:** Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components

**Hydro Power:** Selection of Site, Classification, Layout, Description of Main Components.

**Nuclear Power:** Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors.

**Unit Outcomes:** At the end of the unit, the student will be able to
- Understand the concept of layout and design aspects of Thermal, Hydro and Nuclear Power Plants.
- Obtain the principle of operation of Thermal, Hydro and Nuclear Power Plants.

UNIT-II  NON CONVENTIONAL POWER GENERATING SYSTEMS


**Wind Power Generation:** Role and potential of Wind Energy Options, Horizontal and Vertical Axis Wind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

**Biogas Power Generation:** Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

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Unit Outcomes: At the end of the unit, the student will be able to
- Understand the concept of design of Solar, Wind, Bio-Gas, Geothermal and Ocean Power generation.

UNIT-III TRANSMISSION LINE PARAMETERS
Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

Unit Outcomes: At the end of the unit, the student will be able to
1. Obtain the transmission line parameters for different types of lines and also for symmetrical and asymmetrical single and three phase, single and double circuit lines.

UNIT – IV MODELING OF TRANSMISSION LINES

Unit Outcomes: At the end of the unit, the student will be able to
- Obtain the classification of transmission lines and A,B,C,D constants for transmission lines, need of shunt compensation.
UNIT-V GENERAL ASPECTS OF DISTRIBUTION SYSTEMS

Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over-Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.

SUBSTATIONS:
Location of Substations: Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.
Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment.
Bus bar arrangements in Sub- Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar, Double breaker – One and half breaker system with relevant diagrams, lightening arrestors, Substation grounding.

Unit Outcomes: At the end of the unit, the student will be able to
- Compare DC vs AC and Under-Ground vs Over-Head Distribution Systems, types of Distribution Systems.
- Get the knowledge about Design of Distribution Feeders, Voltage Drop and power loss in A.C. Distributors.
- Learn Substation and types of Substations, Various arrangements in Substations.

Course Outcomes:
After completing the course, the student should be able to do the following:
CO1 Remember and understand the concepts of conventional and nonconventional power generating systems.
CO2 Apply the economic aspects to the power generating systems.
CO3 Analyse the transmission lines and obtain the transmission line parameters and constants.
CO4 Design and Develop the schemes to improve the generation and capability of transmission line to meet the day to day power requirements.
TEXT BOOKS:


REFERENCE BOOKS:

UNIT-I

Magnetic Material Properties and Applications:
Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.

Principles of electromechanical energy conversion:
Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems

Unit Outcomes:
- Able to understand the electromechanical energy conversion system
- To understand about various magnetic materials, properties and Applications

UNIT-II

DC Generators
Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators.
Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections

Unit Outcomes:
- Able to understand the construction, operation and armature windings of a DC generator
- Able to analyze the characteristics of DC generators
UNIT-III

DC Motors
Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors(Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency

Testing of DC machines: Brake test, Swinburne’s test, Hopkinson's test, Fields test, Retardation test.

Unit Outcomes:
- Able to analyze speed control of DC motors, testing methods and parallel operation of DC machines
- Analyze the characteristics of DC motors

UNIT-IV

Single Phase Transformers
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams(no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner’s test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

Unit Outcomes:
- Able to understand the construction, operation and parallel operation of transformer
- To predetermine the efficiency and regulation of a transformer

UNIT-V

Three Phase Transformers
Unit Outcomes:

- Able to understand and analyze the phase conversions
- Analyze the tap changing of transformers

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits.
- Understand the operation of DC machines.
- Analyse the differences in operation of different DC machine configurations.
- Analyse single phase and three phase transformers circuits.

Text Books:


References:

Course Objectives:

- To study the characteristics of various types of semiconductor devices.
- To apply the characteristics of semiconductor devices to develop engineering solutions.
- To analyze functioning of various types of electronic devices and circuits.

Unit1

p-n junction Diode: Qualitative theory of the p-n junction, p-n junction as a diode, current components in a p-n diode, Volt-Ampere characteristics, Temperature dependence of p-n diode characteristics, Diode resistance, Qualitative treatment of Transition and Diffusion capacitances. Diode as Rectifier: Half wave and Full wave rectifier, Bridge rectifier, Filters – Inductor and Capacitor Filter. Ripple factor with and without filters.

Unit Outcomes:

- Explain the concept of p-n junction as diode (L2)
- Apply the concept of diode for developing rectifiers (L3)
- Analyse temperature dependence of diode characteristics (L4)

Unit2

Special Purpose Diodes: Zener versus Avalanche breakdown, Principle of operation, characteristics and applications of Zener diode, Tunnel diode, Photo diode, LED, PIN diode, Schottky barrier diode and Varactor diode.

Bi-Polar Junction Transistor: Junction transistor, Transistor current components, Transistor as an amplifier, Input and Output characteristics of BJT in Common Base, Common Emitter and Common Collector configurations. Transistor as a switch.
Unit Outcomes:

- Study the characteristics of various special purpose diodes and BJT (L2)
- Apply the concepts of special purpose diodes and BJT to solve engineering problems (L3)
- Compare the BJT characteristics in various configurations (L4)

Unit 3

Transistor biasing and Stabilization: The Operating Point, DC & AC load lines, Bias Stability, Fixed Bias, Collector-to-Base Bias, Self-Bias, Bias Stabilization, Bias Compensation, Thermistor and Sensistor Compensation, Thermal Runaway, Thermal Stability.

Small Signal Low-frequency Transistor Models: Transistor Hybrid Model, Determination of the h parameters from the characteristics, Analysis of Transistor amplifier using h parameters, Comparison of Transistor amplifier configurations.

Unit Outcomes:

- Explain the concept of biasing and its temperature stability and compensation (L2)
- Apply transistor hybrid model to calculate h-parameters (L3)
- Analyse transistor amplifier using h-parameters (L4)

Unit 4

Low-frequency Transistor Amplifier circuits: Simplified Common-emitter Hybrid Model, Simplified Calculations for the Common-Collector, Common-base and Common-emitter amplifier, Common emitter amplifier by passed and un-bypassed Emitter Resistance, Miller’s Theorem, Dual of Miller’s Theorem.

Unit outcomes:

- State Miller’s and dual of Miller’s theorems (L1)
- Apply the concept of BJT to develop amplifier circuits (L3)
- Analyse the simplified hybrid model of transistor in various configurations (L4)

Unit 5


**Unit outcomes:**

- Study the characteristics of JFET, MOSFET and UJT (L2)
- Apply the characteristics of FETs and UJT to develop engineering solutions (L3)

**Course Outcomes:**

CO1. List various types of semiconductor devices (L1)
CO2. Study the characteristics of various types of semiconductor devices (L2)
CO3. Apply the characteristics of semiconductor devices to develop engineering solutions (L3)
CO4. Analyse functioning of various types of electronic devices and circuits (L4)

**Text Books:**


**References:**

Course Objectives:

- To teach significance of number systems, conversions, binary codes and functionality of logic gates.
- To discuss different simplification methods for minimizing Boolean functions.
- To impart knowledge on operation, characteristics and various configurations of TTL and CMOS logic families.
- To outline procedures for the analysis and design of combinational and sequential logic circuits.
- To introduce programmable logic devices.

Unit I

Number Systems and Codes: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, ASCII code, Excess -3 codes, Gray code.

Binary codes Classification, Error detection and correction – Parity generators and checkers – Fixed point and floating-point arithmetic.

Boolean Algebra & Logic Gates: Boolean operations, Boolean functions, Algebraic manipulations, Min-terms and Maxterms, Sum-of-products and Product-of-sum representations, Two-input logic gates, NAND /NOR implementations.

Minimization of Boolean Functions: Karnaughmap, Don’t-care conditions, Prime implicants, Minimization of functions using Quine-McClusky method.

Unit Outcomes:

- Summarize advantages of using different number systems. (L2)
- Explain usefulness of different coding schemes and functionality of logic gates. (L2)
- Apply basic laws and De Morgan’s theorems to simplify Boolean expressions. (L3)
- Compare K-Map and Q-M methods of minimizing logic functions. (L5)

Unit II


Unit Outcomes:

- Apply Boolean algebra for describing combinational digital circuits. (L2)
- Analyze standard combinational circuits such as adders, subtractors, multipliers, comparators etc. (L4)
- Design various Combinational logic circuits. (L4)
- Implement logic functions with decoders and multiplexers. (L5)

Unit III

Sequential Circuits-2: Analysis and Design of Synchronous Sequential Circuits: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment, Synthesis using flip flops, Elements of Design style, Top-down design, Algorithmic state Machines (ASM), ASM chart notations.

Registers and Counters: Registers, shift registers, Ripple counters, Synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

Unit Outcomes:

- Describe behaviour of Flip-Flops and Latches.(L2)
- Compare Moore and Mealy machine models.(L5)
- Design synchronous sequential circuits using flip flops and construct digital systems using components such as registers and counters (L4)
- Utilize concepts of state and state transition for analysis and design of sequential circuits (L3)

Unit IV

Memory and Programmable Logic: RAM, Types of Memories, Memory decoding, ROM, Types of ROM, Programmable Logic Devices (PLDs): Basic concepts, PROM as PLD, Programmable Array Logic (PAL) and Programmable Logic Array (PLA), Design of combinational and sequential circuits using PLDs.
Unit Outcomes:
- Define RAM, ROM, PROM, EPROM and PLDs. (L1)
- Describe functional differences between different types of RAM & ROM. (L2)
- Compare different types of Programmable Logic Devices. (L5)
- Design simple digital systems using PLDs. (L4)

Unit V

Digital Logic Families: Unipolar and Bipolar Logic Families, Transistor-Transistor Logic (TTL): Operation of TTL, Current sink logic, TTL with active pull up, TTL with open collector output, Shockley TTL, TTL characteristics, \( \overline{I}_L \), ECL logic Families.
CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations - Wired Logic, Open drain outputs, Interfacing: TTL to CMOS and CMOS to TTL, Tristate Logic, Characteristics of Digital ICs: Speed, power dissipation, figure of merit, fan-out, Current and voltage parameters, Noise immunity, operating temperature range, power supply requirements.

Unit Outcomes:
- Summarize significance of various TTL, \( \overline{I}_L \), ECL and CMOS subfamilies. (L2)
- Examine Interface aspects of TTL & CMOS logic families. (L5)
- Explain characteristics of digital ICs such as speed, power dissipation, figure of merit, fan-out, noise immunity etc. (L2)
- Compare bipolar and MOS logic families. (L5)

Course Outcomes:

After completion of the course, student will be able to
CO1: Understand various number systems, error detecting, correcting binary codes, logic families, combinational and sequential circuits. (L1)
CO2: Apply Boolean laws, k-map and Q-M methods to minimize switching functions. Also describe the various performance metrics for logic families. (L2)
CO3: Design combinational and sequential logic circuits. (L4)
CO4: Compare different types of Programmable logic devices and logic families. (L5)
TEXTBOOKS:


REFERENCES:

Course Objectives:
To conduct various experiments on
- DC motors and DC Generators
- The speed control techniques of DC motors.
- To conduct various experiments for testing on 1-phase transformers

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
5. Speed control of DC shunt motor (Armature control and Field control method).
7. OC and SC test on single phase transformer
8. Parallel operation of single phase transformers.
9. Sumpner’s test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of characteristics.
11. Load test on DC short shunt compound generator. Determination of characteristics.

Note: Minimum ten experiments are required to be conducted as compulsory experiments:

Course Outcomes:
CO1 Able to conduct and analyze load test on DC shunt generators
CO2 Able to understand and analyze magnetization characteristics of DC shunt generator
CO3 Able to understand and analyze speed control techniques and efficiency of DC machines
CO4 Able to understand to predetermine efficiency and regulation of single phase Transformers

Reference Book:
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

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19A04306P SEMICONDUCTOR DEVICES AND CIRCUITS LAB

All the experiments shall be conducted and there is no choice.

List of Experiments:

1. Draw and study the characteristics of Semi-conductor diode and calculate static and dynamic resistance
2. Draw and study the characteristics of Zener Diode and study its application as Regulator
3. Draw and study the input and output characteristics of Transistor in Common Emitter configuration
4. Draw and study the input and output characteristics of Transistor in Common Base configuration
5. Draw and study the drain and transfer characteristics of FET in Common Source Configuration
6. Draw and study the characteristics of UJT
7. Rectifiers
   a. To simulate the rectifiers and trace their output waveforms with and without filters using PSPICE / Multisim
   b. To design half wave, full wave & bridge rectifiers with and without filters, using discrete components and calculate ripple factor in each case.
8. Common Emitter Amplifier (Self bias Amplifier)
   a. Design and simulate self- bias Common Emitter amplifier using PSPICE / Multisim and study the Gain and Bandwidth of the amplifier
   b. Designself- bias Common Emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response
9. Miller’s and Dual of Millers’s theorem
   a. Design and simulate to Prove the Miller’s and dual of Miller’s theorem in CE amplifier
   b. Design and construct the amplifier with discrete components to prove Miller’s and dual of Miller’s theorem
10. FET Amplifier
    a. Design and simulate common source FET amplifier using PSPICE / Multisim and study the Gain and Bandwidth of amplifier
    b. Design common source FET amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response
### 19A02301P  BASIC ELECTRICAL CIRCUITS LAB

Hands-on experiments related to the course contents of **Electrical Circuit Analysis**

1. Verification of Thevenin’s and Norton’s Theorems
2. Verification of Superposition Theorem for average and rms values
3. Maximum Power Transfer Theorem for DC and AC circuits
4. Verification of Compensation Theorem for DC circuits
5. Verification of Reciprocity, Millmann’s Theorems for DC circuits
6. Determination of Self, Mutual Inductances and Coefficient of Coupling
7. Measurement of Active Power for Star Connected Balanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads

### Course Outcomes:

At the end of the course, students will be able to

**CO1:** Remember, understand and apply various theorems and verify practically.

**CO2:** Understand and analyze active, reactive power measurements in three phase balanced & unbalanced circuits.
B.Tech – II-I Sem

19A99302 BIOLOGY FOR ENGINEERS

Course Objectives: To provide basic understanding about life and life Process. Animal an plant systems. To understand what bimolecules, are, their structures are functions. Application of certain bimolecules in Industry.

- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

Unit I: Introduction to Basic Biology


Unit Outcomes:
After completing this unit, the student will be able to
- Summarize the basis of life. (L1)
- Understand the difference between lower organisms (prokaryotes) from higher organisms (eukaryotes). (L2)
- Understand how organisms are classified. (L3)

Unit II: Introduction to Biomolecules

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit Outcomes:
After completing this unit, the student will be able to
- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)
Unit III: Human Physiology

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:
After completing this unit, the student will be able to
- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA technology. Introduction to gene cloning.

Unit Outcomes:
After completing this unit, the student will be able to
- Understand and explain about gene structure and replication in prokaryotes and Eukaryotes (L1)
- How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields.(L3)
- Explain what is cloning. (L4)

Unit V: Application of Biology


Unit Outcomes:
After completing this unit, the student will be able to Understand.
- How biology is applied for production of useful products for mankind.(L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)
Course Outcomes:

After studying the course, the student will be able to:

- Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
- Explain about biomolecules, their structure and function and their role in the living organisms. How biomolecules are useful in Industry.
- Briefly about human physiology.
- Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.
- Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals.

Text books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications -

Reference Books:

Course Objective:
This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

Unit-I: Solution of Algebraic & Transcendental Equations:
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method


Unit Outcomes:
Students will be able to
- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

Unit-II: Interpolation
Finite differences-Newton’s forward and backward interpolation formulae – Lagrange’s formulae. Gauss forward and backward formula, Stirling’s formula, Bessel’s formula.

Unit Outcomes:
Students will be able to
- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton’s forward and backward formulae.
- Derive interpolating polynomial using Lagrange’s formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.
Unit-III: Numerical Integration & Solution of Initial Value Problems to Ordinary Differential Equations

Numerical Integration: Trapezoidal rule – Simpson’s 1/3 Rule – Simpson’s 3/8 Rule

Unit Outcomes:
Students will be able to
- Solve integral equations using Simson’s 1/3 and Simson’s 3/8 rule.
- Solve integral equations using Trapezoidal rule.
- Solve initial value problems to ordinary differential equations using Taylor’s method.
- Solve initial value problems to ordinary differential equations using Euler’s method and Runge Kutta methods.

Unit-IV: Probability theory:
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye’s theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

Unit Outcomes:
Students will be able to
- Understand the concept of Probability.
- Solve problems on probability using addition law and multiplication law.
- Understand Random variables and probability mass and density functions.
- Understand statistical constants of random variables.

Unit-V: Random Variables & Distributions:
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

Unit Outcomes:
Students will be able to
- Understand Probability distribution function.
- Solve problems on Binomial distribution.
- Solve problems on Poisson distribution.
- Solve problems on Normal distribution.
Course Outcomes:

After the completion of course, students will be able to
- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.

Text Books:

2. Ronald E. Walpole, “Probability and Statistics for Engineers and Scientists”, PNIE.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

Reference Books:

Course Objectives:

- To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
- To know the applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources.
- Study of Different types of filters, equalizers.

Unit - I: Locus Diagrams & Resonance

Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

Unit Outcomes:

The student will be able to

- Learn about basic concepts of Locus diagrams with different parameter variations of Electrical circuit elements
- Learn about occurrence of resonance with the presence of electrical circuit elements under certain operating conditions

Unit - II: Two Port Networks

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

Unit Outcomes:

The student will be able to

- Understand and estimate the network parameters of T & π configurations of DC circuits or resistive elements
- Understand how Laplace transforms studied in mathematics courses, can be applied to identifying energy storage elements in electrical circuits
Unit - III: Transient Analysis


Unit Outcomes:
The student will be able to
- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in DC excitations
- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in sinusoidal excitations

Unit - IV: Fourier Transforms


Unit Outcomes:
The student will be able to
- Know how to apply Fourier transforms studied in Mathematics to Electrical circuits for non-sinusoidal periodic and non-periodic input waves
- Understand properties of Fourier series and Transforms

Unit - V: Filters


Unit Outcomes:
The student will be able to
- Understand about what is a Filter, Classification, where they can be used, etc.
- Understand about attenuators and equalizers used in electronic high frequency circuits
Course Outcomes:

- Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
- Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known.
- Design of filters, equalizers and PSPICE programs for Circuit Analysis.

Text Books:


Reference Books:

Course Objectives:

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

UNIT-I  ELECTROSTATICS


Unit Outcomes:

- Able to Determine electric field and potentials using Coulomb’s law & Gauss law.
- Analyze Potential differences for different configurations.
- Able to Classify static electric magnetic fields in different engineering situations.
- Able to Determine the Concepts of Electric dipole, Electrostatic Energy and Energy density.

UNIT- II  CONDUCTORS AND DIELECTRICS

Unit Outcomes:
- Analyze the Concepts of Conduction and Convection currents.
- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.
- Able to Calculate Energy stored and energy density in a static electric fields.

UNIT-III MAGNETO STATICS


Unit Outcomes:
- Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law.
- Able to understand Maxwell’s equations.
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in different loops.

UNIT – IV MAGNETIC POTENTIAL


Unit Outcomes:
- Understand scalar magnetic potential and vector magnetic potential and its applications.
- Able to calculate the magnetic forces and torque produced by currents in Magnetic Field.
- Ability to calculate self and mutual Inductances.
- Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic field.
UNIT-V TIMEVARYING FIELDS


Unit Outcomes:
- Acquires knowledge on time varying fields & Faraday’s law for Electromagnetic induction
- Analyze the Concepts Maxwell’s Equations in Different Forms.
- Understand the Concepts Calculation of Poynting vector & Theorem.
- Analyze the Concepts of Wave Theory

Course Outcomes:
After completion of the course, the student will be able to:
- Understand the concept of electrostatics
- Understand the concepts of Conductors and Dielectrics
- Understand the fundamental laws related to Magneto Statics
- Understand the concepts of Magnetic Potential and Time varying Fields

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives:
The student will be able to:
1. Understand the differences between signal level and power level devices.
2. Analyze controlled rectifier circuits.
3. Analyze the operation of DC-DC choppers.
4. Analyze the operation of voltage source inverters.

UNIT-I: Power Switching Devices
Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Unit Outcomes:
At the end of the unit, students will be able to
- Understand the basic power semiconductor devices their construction, principle of working and their characteristics.
- Understand in detail about SCR i.e., its characteristics, series and parallel connection of SCR’s, specification, its ratings and various commutation methods.
- Apply the above concepts to solve numerical problems.

UNIT-II: Thyristor Rectifiers
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor-Numerical problems.

Unit Outcomes:
At the end of the unit, students will be able to
- Understand the concepts of phase control technique, midpoint and bridge connections of half and full controlled converters with various loads for both 1Ø and 3Ø phase converters, effect of source inductance and dual converters.
- Analyze and evaluate voltages and currents, active and reactive power inputs to converter with and without freewheeling diode for 1Ø and 3Ø converters.
- Apply the above concepts to solve numerical problems.
UNIT-III: DC-DC buck converter

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

DC-DC boost converter:
Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Unit Outcomes:
At the end of the unit, students will be able to
- Understand the concepts of various control strategies, types of choppers and analyze their principle operation, waveforms of voltages and currents at different loads.
- Apply the above concepts to solve numerical problems.

UNIT-IV:

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

Unit Outcomes:
At the end of the unit, students will be able to
- Understand the construction, working of single phase voltage inverters with their waveforms in various operating modes when different loads are applied and the different modulating techniques available.
- Understand the construction, working of three phase voltage inverters with their waveforms in various operating modes when different loads are applied, harmonic components and the different modulating techniques available.
- Apply the above concepts to solve numerical problems.
UNIT-V: AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:


Unit Outcomes:

At the end of the unit, students will be able to
- Understand the concept of AC voltage controllers
- Understand the concept of Cyclo Converters

Course Outcomes:

At the end of this course students will be able to:
- Understand the operation, characteristics and usage of basic Power Semiconductor Devices.
- Understand different types of Rectifier circuits with different operating conditions.
- Understand DC-DC converters operation and analysis of their characteristics.
- Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters.
- Apply all the above concepts to solve various numerical problem solving

TEXT BOOKS:


REFERENCE BOOKS:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem

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19A04405 ANALOG ELECTRONIC CIRCUITS

Course Objectives:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

Unit 1

Multistage Amplifiers: Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

Unit outcomes:

- Name different coupling schemes in amplifiers (L1)
- Explain the principles of Darlington amplifier (L2)
- Apply multistage amplifiers to solve engineering problems (L3)
- Analyse multistage amplifiers (L4)
- Justify choice of transistor configuration in a cascade amplifier (L5)

Unit 2


Oscillators
Sinusoidal Oscillators, Conditions for oscillations, Phase - shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).
Unit Outcomes:
- Classify feedback amplifiers and oscillators (L1)
- Explain the concept of feedback and conditions for oscillations (L2)
- Apply the feedback amplifiers and oscillators to solve engineering problems (L3)
- Analyse feedback amplifiers and oscillator (L4)

Unit 3


Unit Outcomes:
- Classify the large signal amplifiers (L1)
- Explain the operation of different types of large signal amplifiers (L2)
- Apply large signal amplifiers in a given engineering situation (L3)
- Analyse harmonic distortion in large signal amplifiers (L4)

Unit 4: Linear Integrated Circuits:


Unit Outcomes:
- Understand different Offsets present in Op amp & nullification circuits. (L1)
- Examine performance of Op-Amp in open loop and closed configurations. (L2)
- Analyse emitter-coupled differential amplifier. (L3)
- Compare ideal and practical Op-Amps. (L5)

Unit 5: Applications of Linear Integrated Circuits:
Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator.
Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO 566, PLL 565, Fixed and variable Voltage regulators.

Unit Outcomes:
- Understand various applications of Linear ICs (L1)
- Explain operation of Op. Amp. in various applications, Timer, Fixed voltage regulators (L2)
- Apply linear ICs in a given engineering situation (L3)

Course outcomes:
On successful completion of the course, the student shall be able to
CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers (L1)
CO2. Explain the operation of various electronic circuits and linear ICs (L2)
CO3. Apply various types of electronic circuits to solve engineering problems (L3)
CO4. Analyse various electronic circuits and regulated power supplies for proper understanding (L4)
CO5. Justify choice of transistor configuration in a cascade amplifier (L5)
CO6. Design electronic circuits for a given specification (L6)

Text Books:

Reference Books:
Course Objectives:

1. To learn the fundamentals of Python
2. To elucidate problem-solving using a Python programming language
3. To introduce a function-oriented programming paradigm through python
4. To get training in the development of solutions using modular concepts
5. To introduce the programming constructs of python

Unit – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

Unit Outcomes:

Student should be able to

- List the basic constructs of Python.
- Solve the problems by applying modularity principle.

Unit – II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.

Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,
Unit Outcomes:

Student should be able to
- Apply the conditional execution of the program.
- Apply the principle of recursion to solve the problems.

Unit – III

**Iteration**: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.

**Strings**: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.

**Case Study**: Reading word lists, Search, Looping with indices.

**Lists**: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

Unit Outcomes:

Student should be able to
- Use the data structure list.
- Design programs for manipulating strings.

Unit – IV

**Dictionaries**: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.

**Tuples**: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.

**Files**: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.

**Classes and Objects**: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.

Classes and Functions:

Unit Outcomes:

Student should be able to
- Apply object orientation concepts.
- Use data structure dictionaries.
- Organize data in the form of files.
Unit – V

**Classes and Functions**: Time, Pure functions, Modifiers, Prototyping versus Planning

**Classes and Methods**: Object oriented features, Printing objects, The init method, The __str__ method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation

**Inheritance**: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Class diagrams, Data encapsulation.

**The Goodies**: Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, defaultdict, Named tuples, Gathering keyword Args.

**Unit Outcomes**:

Student should be able to
- Plan programs using object orientation approach.
- Illustrate the principle of inheritance.

**Course Outcomes**:

Student should be able to
1. Apply the features of Python language in various real applications.
2. Select appropriate data structure of Python for solving a problem.
3. Design object oriented programs using Python for solving real-world problems.
4. Apply modularity to programs.

**Text books**:


**Reference Books**:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem

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Course Objectives:
1. Understand and experimentally verify various resonance phenomenon
2. Understand and analyze various current locus diagrams.
3. Apply and experimentally analyze two port network parameters
4. Simulation of various circuits using PSpice software.

Experiments:
1. Locus Diagram of RL Series Circuits:
   a) Variable ‘R’ and Fixed ‘L’ b) Variable ‘L’ and Fixed ‘R’
2. Locus Diagram of RC Series Circuits:
   a) Variable ‘R’ and Fixed ‘C’ b) Variable ‘C’ and Fixed ‘R’
3. Series Resonance
4. Parallel Resonance
5. Determination of Z Parameters
6. Determination of Y Parameters
7. Transmission Parameters
8. Hybrid Parameters
9. Determination of Coefficient of coupling

PSpice Simulation Experiments:
1. Simulation of DC Circuits
2. Simulation of AC Circuits
3. DC Transient Response
4. Mesh Analysis
5. Nodal Analysis

References:
19A04406  ELECTRONIC CIRCUITS LAB

Course Objectives:

- To learn basic techniques for the design of analog circuits, digital circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

PART A

List of Experiments:

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.
6. Design inverting and noninverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
7. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.
8. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
Note: Design & simulate any 6 experiments with Multisim / PSPICE or equivalent software and verify the results in hardware lab with discrete components.

PART B
List of Experiments:

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3 – bit Adder / Subtractor
4. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-SJ-K, J-K Master slave flip-flops using gates and verify their truth tables
7. Design and implementation of i) Ring counter and ii) Johnson counter using 43 bit shiftregister
8. Design and realization of 8x1 MUX using 2x1 MUX

Note: Student has to perform minimum of 4 experiments using digital ICs

Course Outcomes:
At the end of this course, students will demonstrate the ability to

- Analyze various amplifier circuits.
- Design multistage amplifiers.
- Design OPAMP based analog circuits.
- Understand working of logic gates.
- Design and implement Combinational and Sequential logic circuits.
Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I


Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Unit Outcomes

- To know the importance of public awareness
- To know about the various resources

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Course Outcomes:**
- To know about various echo systems and their characteristics
- To know about the biodiversity and its conservation

**UNIT – III**

**Environmental Pollution**: Definition, Cause, effects and control measures of:
- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**Course Outcomes:**
- To know about the various sources of pollution.
- To know about the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

**UNIT – IV**


Course Outcomes:
- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.
- To know about the wild life protection and forest conservation acts.

UNIT – V


Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Unit Outcomes:
- To know about the population explosion and family welfare programmes.
- To identify the natural assets and related case studies.

Course Outcomes:
At the end of the course, the student will be able to
- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.
TEXT BOOKS:


REFERENCES:

3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House